

MinXray *HF70D* High Frequency Portable Dental X-ray Unit

Operating Instructions

This special purpose portable equipment is for dental radiography only.
It is not designed, nor does it meet, the Standards for any other use.

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INSTRUCTION MANUAL FOR *BL70* DENTAL CONE

CAUTION: This special purpose beam limiting device is developed for use with an intraoral dental x-ray unit only. It is not designed, nor does it meet, the Standards for any other use.

ASSEMBLY: Carefully screw clockwise the *BL70* dental cone into the cone holder on the front of the x-ray tubehead. Avoid cross-threading the cone when attaching it to the tubehead to prevent leakage radiation and distortion of the x-ray field.
NEVER OPERATE THE X-RAY UNIT UNLESS THE DENTAL CONE IS ATTACHED.

CHECK: Confirm that there are no cracks or chips on the dental cone. If there are any cracks or chips on the dental cone, replace it with a new, intact cone. **NEVER OPERATE THE X-RAY UNIT WITH A DAMAGED DENTAL CONE.**

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INTRODUCTION

The MinXray model *HF70D* is a mono-block type high frequency portable dental x-ray unit. The *HF70D* can be used with conventional intraoral dental film or with solid-state digital radiographic intraoral sensors. It is supplied in a carrying case containing the x-ray tubehead/control, detachable dental cone (beam limiting device), detachable AC power cord, and detachable exposure cord with 2-stage exposure switch. The *HF70D* is designed to be easily attached to the model X100S adjustable tripod stand.

CARELESS OR IMPROPER USE OF X-RAY EQUIPMENT CAN BE EXTREMELY HAZARDOUS. It is imperative that this equipment be operated and serviced only by trained personnel familiar with the safety precautions required to prevent excessive exposure to primary X-ray radiation, the dangers of exposure to X-ray radiation, and the proper use of the equipment discussed in this manual.

All personnel authorized to operate or service this equipment should be fully acquainted with the established maximum permissible doses, safety recommendations, and procedures derived from the following sources:

- A. National Council on Radiation Protection Report No.33 (Medical X-Ray and Gamma Ray Protection for Energies up to 10 MEV - Equipment Design and Use); from NRC Publications; P.O. Box 30175, Washington, D.C. 20014.
- B. National Bureau of Standards Handbook No.76 (Medical X-Ray Protection up to Three Million Volts); from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20401.
- C. All documents relating to the Performance Standard for Diagnostic X-Ray Systems, 21 CFR Subchapter J, Part 1020; obtainable from FDA Center for Devices and Radiological Health, Department of HHS, 2098 Gaither Road, Rockville, MD 20850.
- D. State and local regulations governing radiation protection and the use of diagnostic X-ray equipment.
- E. Requirements of the user's in-house radiation protection program.
- F. Instructions and precautionary notices of this manual.

Although this equipment incorporates protective design features for limiting both the direct (primary) x-ray beam and the secondary radiation produced by this beam, design factors alone cannot prevent human carelessness, negligence, or lack of knowledge. This apparatus is sold with the understanding that the user assumes sole responsibility for radiation safety and that MinXray, Inc., its agents and representatives, do not accept any responsibility for:

- A. Injury or danger to patient or other personnel from x-ray exposure.
- B. Overexposure due to poor operating techniques or procedures.
- C. Equipment not properly serviced or maintained in accordance with this manual.
- D. Equipment which has been modified or tampered with in any way.
- E. Equipment that has been connected to input voltage other than the voltage specified on the rating label affixed to the x-ray unit.

MinXray *HF70D*

INSTALLATION INSTRUCTIONS

Unpacking

The MinXray *HF70D* portable x-ray unit consists of an x-ray tubehead and control, mounting handle, dental cone, exposure cord, power cord, and carrying case.

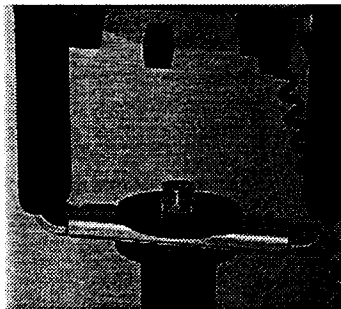
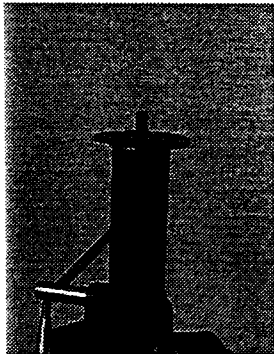
If a stand is purchased with the *HF70D*, instructions for its assembly are included with the stand.

When the equipment is received each shipping container should be carefully examined for any evidence of mishandling during shipment. Note its condition, if abnormal, carefully unpack all parts and examine for damage. If any damage is noted, immediately report it to the carrier in the proper manner, by personally calling it to attention by phone where possible, and filing a written report.

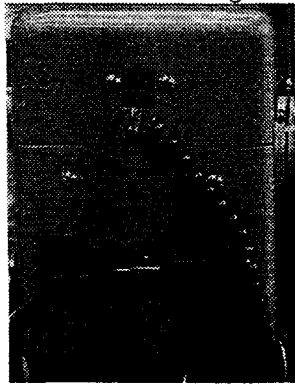
All printed matter supplied with the *HF70D* should be saved for reference during installation and operation.

Assembly Instructions

1. Remove the *HF70D*, dental cone, power cord, and exposure cord from the carrying case.
2. If the *HF70D* will be attached to the top of the center post of the X100S tripod stand, rotate the carrying handle of the *HF70D* around the rear of the unit so it is positioned under the unit. Place one flat black rubber washer on the thread stud on the center post of the tripod. Insert the threaded stud on the center post of the tripod through the hole in the center of the carrying handle of the *HF70D*. Place the second flat black rubber washer on the stud of the tripod center post and on top of the *HF70D* carrying handle. Affix the *HF70D* to the tripod using the brass thumb nut. Adjust the length of each telescoping tripod leg, and lock it. Adjust the height of the center post and lock it.



3. Carefully screw the dental cone into the cone holder on the front of the *HF70D*. Avoid cross-threading the cone when attaching it to the *HF70D*. NEVER OPERATE THE *HF70D* UNLESS THE DENTAL CONE IS ATTACHED.
4. Connect the AC power cord to the socket on the back of the *HF70D*. Note the rated voltage of the *HF70D* before connecting it to a power source.



5. Connect the exposure cord to the RJ11 telephone-type socket on the back of the *HF70D*.

PRE-OPERATIONAL REQUIRED TESTING

The following test is the responsibility of the dealer and must be conducted without fail. Fill out the checklist for this report, when installation of x-ray unit is complete.

1. EXPOSURE TIMER

1-1 Test method:

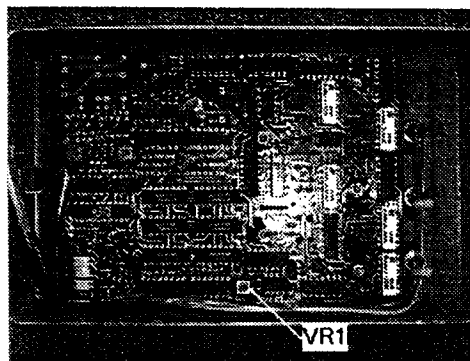
1. Set *HF70D* exposure timer to 0.02 sec.
2. Set *HF70D* output to 70kV.
3. Set NERO to the following settings.
SID: 18 inches; Wheel range: 50 ~ 85kV; Sensitivity: Low; Phase select: 1Ø;
Measurement mode: STAT; X-ray values: 70kV, 0.02 sec.
4. Make exposure and read the measured value of exposure time on the NERO.
5. Measure value of exposure time at following settings with same procedure: 0.02, 0.04, 0.10, 0.20, 0.50, and 1.00 sec.

1-2 Instruments: NERO Model 6000M x-ray beam analyzer
Manufactured by Victoreen, Inc. or equivalent

1-3 Rejection limit: $\pm 20\%$ (0.02 sec. ~ 0.2sec.), $\pm 10\%$ (0.22sec. ~ 1.98sec.)

If the timer needs adjustment: (1) remove the 4 screws on the side of the top cover of the *HF70D*, and lift the top off of the body of the unit; (2) adjust the potentiometer "VR1" on the printed circuit board M3115 on the inside of the top cover (see Fig.1) so that radiation exposure time equals the indicated time value, taking into consideration the accuracy tolerances; (3) replace the top cover and 4 screws.

Fig.1



2. PEAK TUBE POTENTIAL

2-1 Test method:

1. Set *HF70D* exposure timer to 0.2 sec., and set kV to 60kV.
2. Set NERO to the following settings:
SID: 18 inches; Wheel range: 50 ~ 85kV; Sensitivity Hi; Phase select: 1Ø; Measurement mode: SGL; Time delay 0.1sec; X-ray values: 60kV, 0.2 sec.
3. Make exposure and read the measured AVG. kV value on the NERO.
4. Measure also value of AVG. kV at 65kV, 70kV with same procedure.

2-2 Instruments: NERO Model 6000M x-ray beam analyzer
Manufactured by Victoreen, Inc. or equivalent

2-3 Rejection limit: $\pm 10\%$

If the peak tube potential needs adjustment: (1) remove the 4 screws on the side of the top cover of the *HF70D*, and lift the top off of the body of the unit; (2) adjust the potentiometer "VR1" on the printed circuit board M9142 located on top of the lower portion of the unit (see Fig. 2) so that peak tube potential equals the indicated kV value, taking into consideration the accuracy tolerances; (3) replace the top cover and 4 screws.

3. TUBE CURRENT

3-1 Test method:

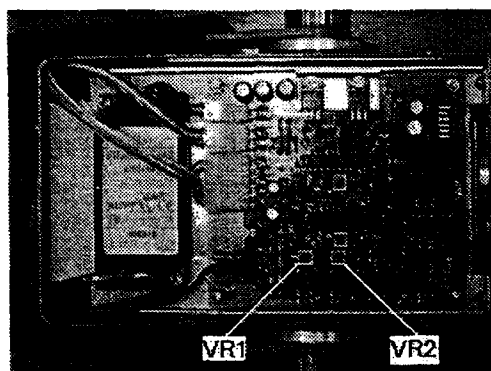
1. Set *HF70D* to 60kV, and timer to 0.2sec.
2. Set oscilloscope to the following settings.
ch 1:Ep, ch 2:Ip, ch1 V/div: 1V, ch2 V/div: 500mV, sec/div: 25 msec,
trigger level: ch1 1.5V
3. Open the top cover of the *HF70D* by removing the 4 screws and lifting the cover off of the unit. Connect ch 1 of oscilloscope to Ep pin of PC board M9142 and connect ch 2 of oscilloscope to Ip pin of PC board M9142. Connect GND line of probe to GND pin of PC board M9142.
4. Measure Hi value of ch 2.
5. Measure Hi value of ch 2 at 70 kV and 0.2 sec. with same procedure.

3-2 Instruments: Digital Storage & Analog Oscilloscope 2212
Manufactured by Tektronix Holland, N.V. or equivalent

3-3 Rejection limit: $\pm 10\%$

If the tube current needs adjustment: (1) adjust the potentiometer "VR2" on the printed circuit board M9142 (see Fig. 2) so that tube current equals 10 mA, taking into consideration the accuracy tolerances; (2) replace the top cover and 4 screws.

Fig.2



INSTALLATION CHECK LIST

INSTALLATION CHECK LIST	HF70D	
	Fill out this checklist when installation is complete.	SERIAL NO.
		DATE MANUFACTURED
EQUIPMENT LOCATION 		

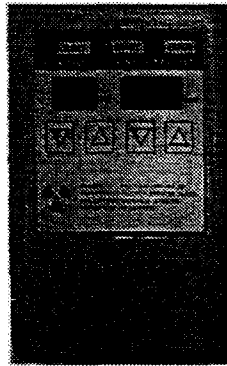
TEST DESCRIPTION	ACCEPTANCE LIMITS	RESULTS	CHECK
Line Voltage	110~130V (220~260V)	V	☐ GO ☐ NO GO
Line Voltage Regulation	2~5%	%	☐ GO ☐ NO GO
Peak Tube Potential	60 kV±10% 65 kV±10% 70 kV±10%	kV kV kV	☐ GO ☐ NO GO
Tube Current	10mA±10%	mA	☐ GO ☐ NO GO
Exposure Time	0.02sec ±20% 0.04sec ±20% 0.1sec ±20% 0.2sec ±20% 0.5sec ±10% 1.0sec ±10%	sec sec sec sec sec sec	☐ GO ☐ NO GO
All Mechanical Movement	Smooth Movement	/	☐ GO ☐ NO GO
All Operation	See operation Manual	/	☐ GO ☐ NO GO

Instruments Used	Manufacturer	Model	Accuracy	Last calibrated
Dealer Name		Dealer Phone Number		
Dealer Address				
Assembler signature			Date	
Comments				

OPERATION INSTRUCTIONS

Operation

1. Connect the AC power cord to a grounded electrical outlet. Check the label on the *HF70D* for the correct AC input voltage and amperage required.
2. Turn on the main power switch on the *HF70D*. The kV and sec LED displays will light and remain on. The *HF70D* has internal circuitry to automatically compensate for variations in the input voltage to assure consistent kV and mA output.
3. Select the kV output by pressing the arrows below the kV display to choose 60, 65, or 70 kV. 10 mA output is fixed at all kV settings.



4. Select the exposure time by pressing the arrows below the sec display to choose between 0.02 and 1.98 second exposures.
5. Position the x-ray unit for the intraoral image you will be taking.
6. The exposure switch has a 2-stage button.

The first stage pre-heats the filament of the x-ray tube. When this stage alone is depressed and held, "READY" indicator will light after 1.5 seconds, indicating the filament was heated and the unit is ready to generate x-rays.

The second stage initiates the x-ray exposure for the time set in the sec display. When the second stage is fully depressed, x-ray will be emitted, the X-RAY indicator will light, and an audible signal will be heard. PRESS AND HOLD THE FIRST AND SECOND STAGE BUTTONS TOGETHER UNTIL THE EXPOSURE HAS TERMINATED. This is a "dead man" exposure switch--x-ray exposure will terminate immediately as a safety feature when the buttons are released.

7. After each exposure, release the exposure buttons. The *HF70D* is now ready for the next exposure.
8. When you are finished using the *HF70D*, turn off the main power switch, disconnect the AC power cord and exposure cord, unscrew the dental cone, and repack these components with the *HF70D* into the carrying case.

Safety Precautions

1. During exposure the operator must stand as far as possible from the patient being x-rayed, and should wear a lead apron or stand behind a lead shield.
2. The operator must not stand in the primary x-ray beam.
3. The operator should wear a monitoring dosimeter while operating this unit. It should be worn where it is not covered by a lead apron.
4. X-ray exposure should be kept as short as possible.

Maintenance

The following must be checked before each use:

Tubehead

1. Make sure the certification and identification labels are in place.
2. Check for any loose or missing screws.
3. Check for oil leaks.
4. Check for any physical damage.
5. Check the kV adjustment for proper operation.
6. Check the timer for proper operation.
7. Check all cords and cord connections.
8. Check the exposure buttons--the exposure must terminate if the button is released during an exposure.

Dental Cone (beam limiting device)

1. Make sure the certification label is on the cone.
2. Check for any physical damage.

Indicators

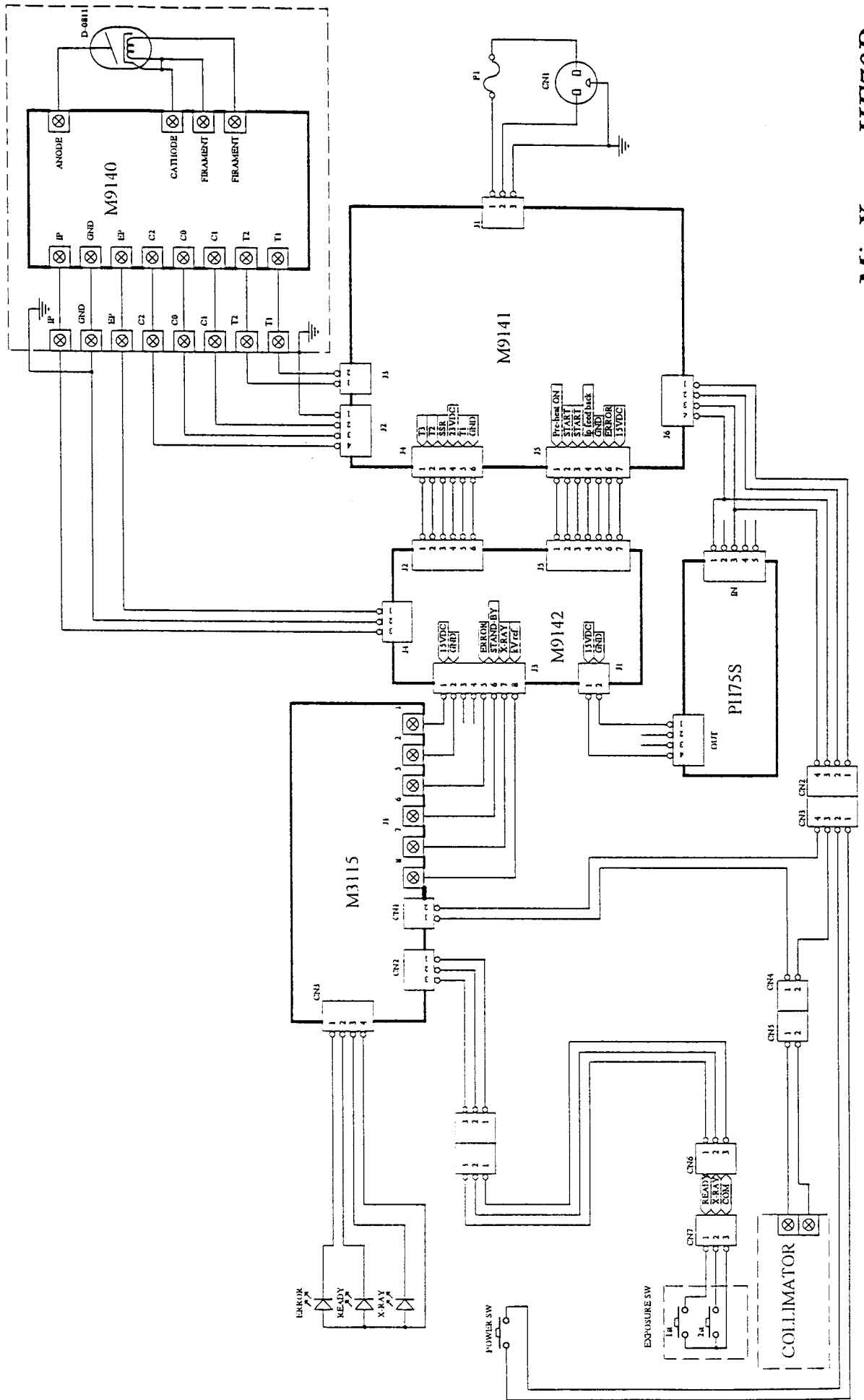
1. Check the X-RAY indicator for proper operation when both exposure buttons are depressed and held.
2. Make sure the audible signal operates during an exposure.

Have this unit checked by qualified service personnel immediately if any problems occur with the *HF70D*.

MinXray HF70D Specifications

X-ray Output	10 mA @ 60, 65, 70 kVDC
Exposure Timer	0.02 - 1.98 seconds, 99 steps
Line Voltage	110-130V, 50/60 Hz 220-260V, 50/60 Hz
Generator rating	10 mA at 70 kVDC $\pm 15\%$
Current draw at 10mA, 70 kVDC out put.	15 amps
Inverter Frequency	75 kHz
Maximum deviation from fixed factor	$\pm 10\%$ (mA), $\pm 10\%$ (kV), $\pm 20\%$ (Time: 0.02-0.20 sec.), $\pm 10\%$ (Time: 0.22-1.98 sec.),
X-ray Tube	Toshiba D-0811 or equivalent
Focal Spot	0.8 mm
Exposure Switch	Two-stage, deadman with RJ11 connector
Exposure Cord	8 feet (2.8 m)
Power Cord	20 feet (6.1 m), 14/3 wire oil resistant
Dental cone (Beam Limiting Device)	Yoshida model BL70 or equivalent
Focus to Cone Tip Distance	7.95" (20.2 cm)
Unit Dimensions	4.8" (12.2cm) W x 5.8" (14.7 cm) H x 7.9" (20.1cm) L, plus dental cone
Weight	9.7 lbs (4.4 kgs.)
Stand	Fits MinXray X100S tripod

The MinXray *HF70D* is compatible with all radiographic imaging modalities, including digital.



MinXray HF70D

STATIONARY ANODE X-RAY TUBE

- ◆ Especially designed for dental X-ray unit.
- ◆ Provided with an insulation cylinder (D-0811S).
- ◆ These tubes have focus 0.8 mm, and are available for maximum tube voltage 70 kV with self-rectified circuit.
- ◆ Installed in the same enclosure with the high tension transformer.

GENERAL DATA

ELECTRICAL:

Circuit	Self-rectified (Center-grounded)
Operating Tube Voltage	50 to 70 kV
Focal Spot	0.8 mm
Input Energy (at 1.0 s)	
See rating charts	600 W

MECHANICAL:

Dimensions	See dimensional outline
Overall Length:	
D-0811	74 mm
D-0811S	74 mm
Max. Diameter:	
D-0811	31 mm
D-0811S	38 mm
Target Angle	16 degrees
Inherent Filtration	At least 0.6 mm Al equivalent at 70 kV
X-ray Coverage	$\phi 107$ mm at SID 200 mm

1990-07-18



Weight (approx.)

D-0811	110 g
D-0811S	150 g
Cooling Method	Oil immersed (60 °C Max.) and convection oil cooling

Tube Holding:

D-0811	Holding the glass envelope of the anode end and cathode end, or the screw of the anode shank.
D-0811S	Holding the insulation cylinder.

MAXIMUM AND MINIMUM RATINGS

(At any time, these values must not be exceeded)

Max. Tube Voltage	70 kV
Max. Inverse Tube Voltage	85 kV
Min. Tube Voltage	50 kV
Max. Tube Current:	
See rating charts	19 mA
Max. Filament Current	3.0 A
Filament Voltage:	
At max. Filament current (3.0A)	3.0 to 3.7 V
Thermal Characteristics:	
Anode Heat Storage Capacity	7 kJ (10 kWh)
Max. Anode Heat Dissipation Rate	210 W (300 HU/s)

CAUTIONS

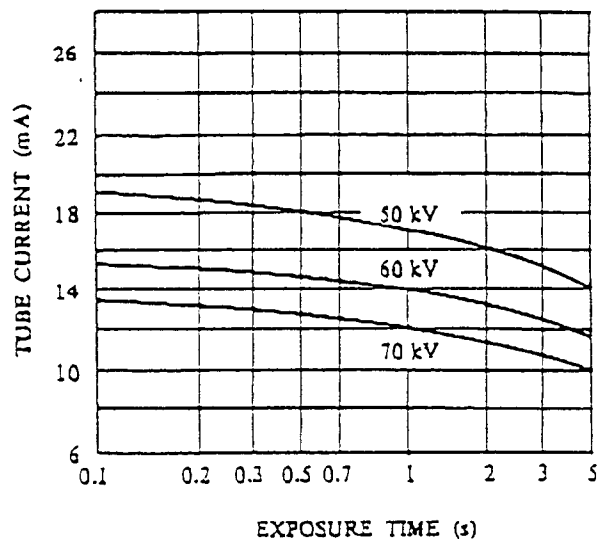
Read through this page before using the tube.

Since X-ray tube will emit X rays when it is energized with high voltage, special knowledge is required to handle it. The items below show general cautions for the tube handling.

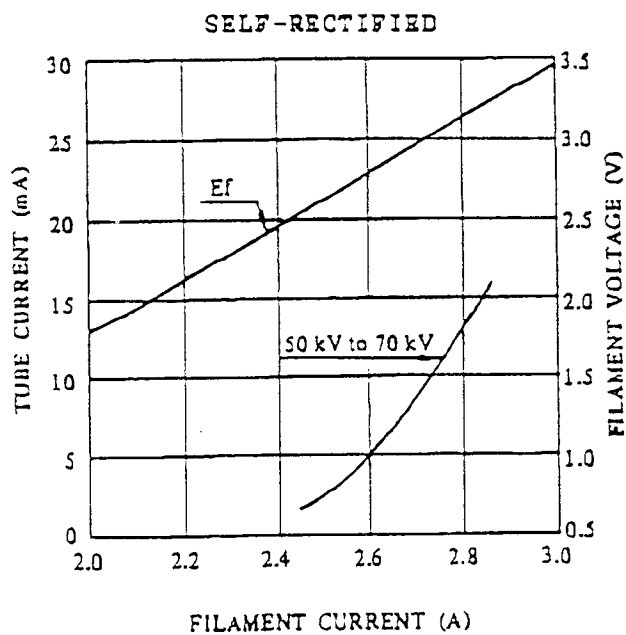
1. The tube shall be handled or operated only by qualified personnel.
Only specialist who has good knowledge of X-ray tube should assemble, maintain and remove the tube.
2. The tube envelope is made of glass. In transporting and handling, sufficient care should be taken not to give strong impact or vibration to the tube.
3. Regulations and standards require the minimum source-skin distance (SSD) and the minimum filtration of the useful beam. Use the tube after fulfilling them.
4. The tube might be broken due to only one overload operation. Provide proper overload protection circuit.
Operate the tube by selecting a proper input condition according to the conditions for operation and tube characteristics charts.
5. If any abnormality is found in using this tube, immediately switch off the power supply and contact TOSHIBA service department.
6. The charts of this technical data is indicating standard values. For usage not described here or for any unclear items, please contact TOSHIBA service department without hesitation.

MAXIMUM RATING CHARTS (ABSOLUTE MAXIMUM RATING CHARTS)

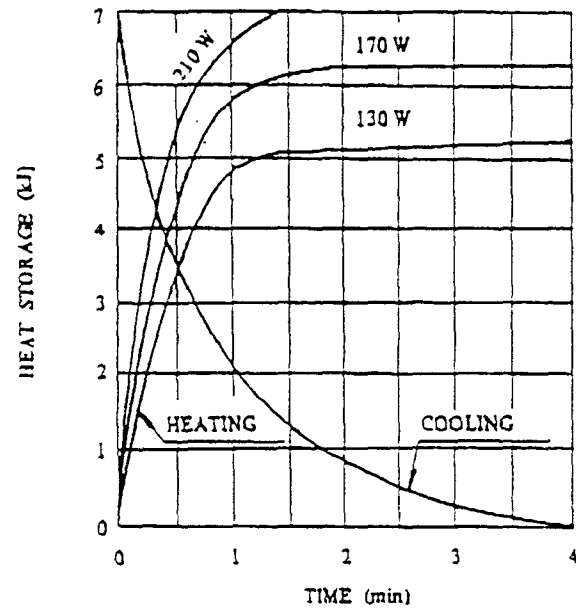
SELF-RECTIFIED
FOCAL SPOT : 0.8 mm



EMISSION & FILAMENT CHARACTERISTICS

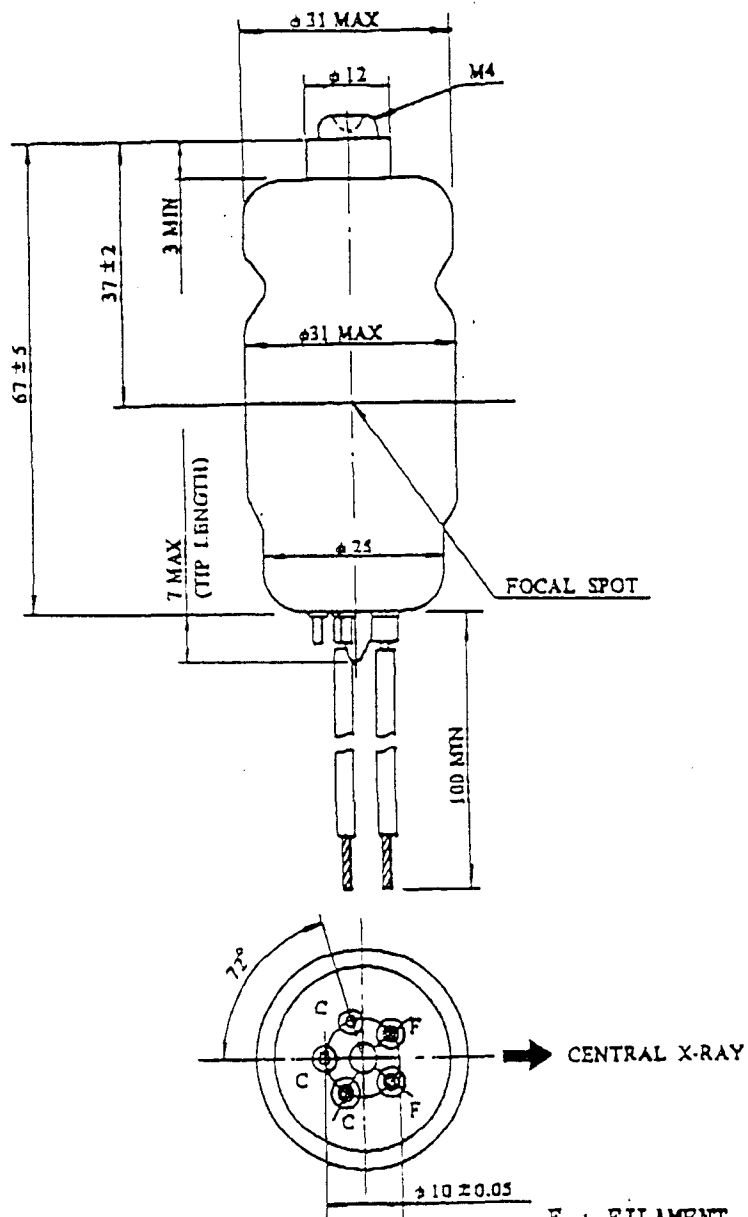


ANODE THERMAL CHARACTERISTICS



DIMENSIONAL OUTLINE

Unit mm



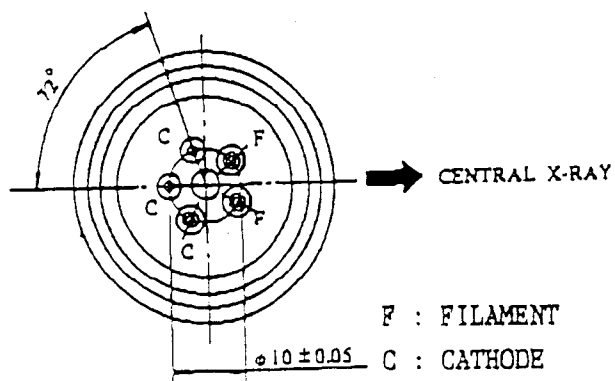
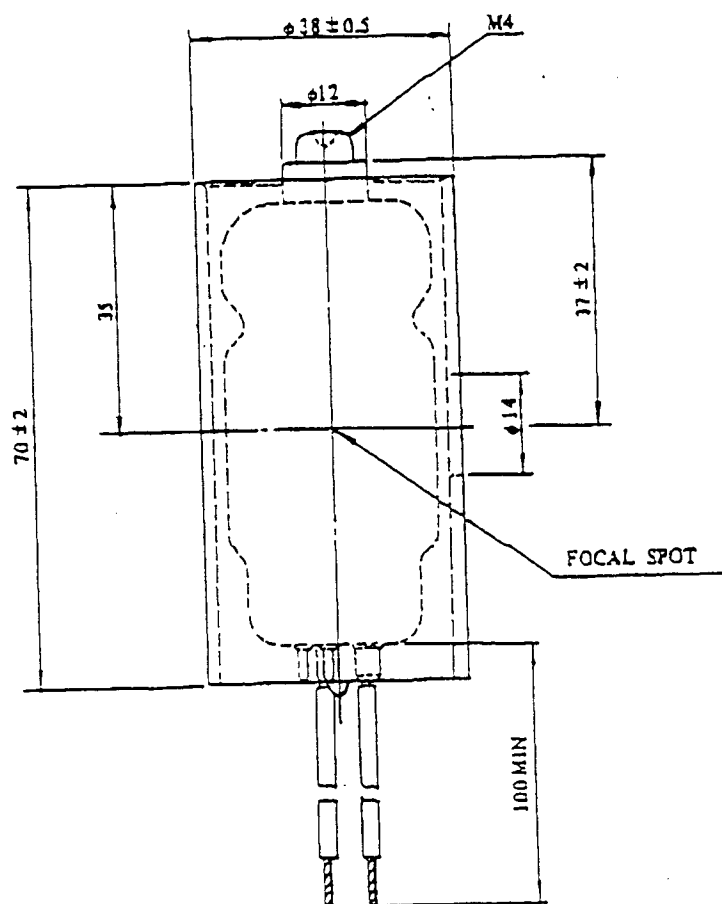
F : FILAMENT

C : CATHODE

Terminals "C" are connected
mutually inside the tube.

DIMENSIONAL OUTLINE

Unit mm



F : FILAMENT

C : CATHODE

Terminals "C" are connected
mutually inside the tube.

MinXray *HF70D* Limited Warranty

MinXray, Inc. warrants the MinXray model *HF70D* portable dental x-ray unit to be free from any defects in material or workmanship for a period of one (1) year from the date of original installation. MinXray, Inc. warrants stands, accessories, and carrying cases purchased from MinXray to be free from any defects in material or manufacture's workmanship for a period of one (1) year from the date of original installation. The warranty on the beam limiting device is provided solely by its manufacturer.

The liability of MinXray, Inc. is limited to repair or replacement of any parts that MinXray determines to be defective. Parts proving defective will be repaired or replaced free of charge, F.O.B. Northbrook, Illinois, U.S.A., if defective equipment is returned to MinXray, Inc. for inspection, freight charges prepaid. All warranty claims must be made not later than ten (10) business days following the expiration of the applicable warranty period. Equipment repaired or replaced under warranty will continue to be warranted for the balance of the original warranty term.

This warranty does not apply to equipment that is or has been abused, misused, or altered, improperly maintained, subjected to use beyond rated conditions, or damaged as a result of any carelessness or accidents. This warranty does not cover ordinary wear and tear or maintenance.

MinXray, Inc. makes no other warranty, either express or implied, with respect to any equipment purchased from MinXray, including without limitation any implied warranties of merchantability or fitness for a particular purpose, whether or not MinXray may have been informed of the actual uses to which any of such equipment may be put. MinXray hereby disclaims all such other warranties. MinXray, Inc. shall not under any circumstances be liable for incidental, indirect, consequential, punitive or exemplary damages, including without limitation damages for delay or lost profits, and in no event shall MinXray's liability arising from the purchase, sale or use of the equipment, or breach of any warranty made above, exceed in the aggregate the purchase price paid therefore.

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